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USSR ZIRCONIUM RESOURCES

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Natural compounds of zirconium may be divided into three groups:

1. Zirconium dioxide, ZrO_2, of various modifications -- baddeleyite.

2. Compounds of zirconium dioxide with silica, $ZrSiO_4$ -- zircon and its varieties.

3. Complex zirconium silicates containing titanium, columbium, tantallum, and other elements -- eudeiolites, catapleiite.

Only two zirconium-containing minerals, baddeleyite and zircon, now have industrial significance. Eudeiolite is not used in industry because of a low content of ZrO_2 and because the presence of iron and titanium hampers the technological process of separating zirconium dioxide.

Baddeleyite is the best zirconium-containing raw material, the richest in zirconium and the simplest in chemical composition. Therefore, search for deposits of this mineral must be encouraged by all means.

Rocks containing zircon as an accessory mineral, such as granites, diorites, and syenites, are widely distributed in the earth's crust. Professor P. Pyatnitskiy presents the following data in his book (Zirconium and the Laws of Its Distribution in Minerals and Rocks, Khar'kov, 1939): Thirteen out of 65 analyses of granites showed a content of zirconium oxide higher than 0.10%, and six of these 13 analyses gave results from 0.42 to 8.10%. In syenitic rocks, eight out of 42 analyses showed higher than a 0.10% content of zirconium oxide, including three analyses with figures from 0.38 to 1.30%. In rocks belonging to

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nephelinic and leucitic syenites, eight out of 34 analyses revealed concentration of zirconium oxide from 1.57 to 4.89%. Here the zirconium-containing mineral is represented in most cases by eudeiolite but in certain cases by zircon as, for example, in deposits near Mariupol' in the USSR. These deposits represent zircon-enriched zones of nephelinic syenite called by the local name "mariupolit."

Magmatic deposits of eudeiolite are known in many countries, including deposits on the Kola Peninsula in the USSR. Eudeiolite deposits have no practical significance, but they are of certain interest as primary deposits from which secondary rich deposits of baddeleyite are formed.

Zirconium ores are unsuitable for direct processing, always requiring a preliminary beneficiation for obtaining sufficiently rich concentrates.

There are no definitely established requirements on the quality of zirconium ores. On the basis of a number of investigations and practical data, it may be assumed that exploitation of even large deposits of eudeiolitic ores is not expedient, since, at present, resources of zircon ores are adequate.

As for zircon ores, they may be of industrial interest even in cases of a comparatively low zirconium oxide content. This is particularly true in respect to the ores easily adaptable to concentration. In any event, ores with a ZrO_2 content of 0.3-0.5% must already attract the attention of geologists. Slimes with this content obtained in exploitation of placers for other metals, for instance, gold, require consideration as a potential source of zirconium.

Side recovery of zirconium during exploitation of other mineral deposits may be worthwhile even when its content in ores amounts merely to hundredths of one percent.

The content of zircon in concentrates usually has to attain 90%. No other requirements are obligatory. However, in the process of beneficiation, all efforts are usually made to obtain zirconium concentrates with a minimum content of iron, aluminum, calcium, silicon, and titanium, because the presence of these elements complicates the processing of concentrates. Besides, the high content of iron and aluminum, decreasing the refractory and acid-proof properties of zircon, makes the concentrates unsuitable for use as a refractory material and enamel opacifier.

The entire history of zirconium production and application on an industrial scale numbers only 35-40 years. For this period, the world's annual output of zirconium raw materials rose from tens of tons to ten-thousands of tons in the recent decade.

In the USSR, the use of domestic zirconium products was initiated prior to the war, mainly in the form of iron-free zircon as an opacifying agent for enamels.

During the war and postwar periods the zirconium industry in the USSR has shown considerable progress, increasing the variety of products and developing new fields of application, such as refractory production, electrical engineering, ferrous and nonferrous metallurgy, etc.

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